국제학석사학위논문

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The case of the European Project Bond Initiative

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Abstract

Infrastructure faces a global lack of investment, that is observable in every region of the world, including the European Union. Even though private investment in infrastructure is made possible with public-private partnerships, that are implemented more and more in the world, the large supply of capital does not meet yet the demand for infrastructure. This market failure has been analyzed by literature as the combination of inappropriate risk-sharing structure of the infrastructure projects and the lack of expertise in infrastructure finance from both public and private sectors. The European Project Bond Initiative, launched in 2011, aims to remediate to these hurdles and to promote access to capital market for infrastructure investments, through a credit enhancement mechanism for project bonds. This thesis will examine to what extent the European instrument facilitate private investments in infrastructure. Analyzing the projects carried out during the pilot phase of the European Project Bond Initiative, this thesis finds that the EPBI improves the risk-sharing and increases infrastructure expertise. However, impact on the highly risky projects remains to be tested.

Keywords: infrastructure, project bonds, European Investment Bank

국문 초록

전반적으로 전세계 모든 지역, 특히 유럽 연합 지역에서 인프라 투자가 미흡하다. 인프라 민간투자사업을 지원하는 공공-민간 파트너쉽 같은 제도가 점점 많이 도입되고 있지만 이렇게 투입된 자본으로도 인프라 수요를 충족시키기에 완전히 부족하다. 이 문제에 관한 문헌에서는 시장 실패의 원인을 살피면서 인프라 프로젝트의 부적합한 위험 부담 방식과 민간부문과 공공부문의 불충분한 인프라 자금에 대한 전문지식을 강조해왔다. '유럽 연합의 프로젝트채권 계획'(European Project Bond Initiative; EPBI)은 이러한 장애를 극복하기 위해 2011 년에 시작되었고 신용보강 메커니즘을 통해 원활하게 자본시장에 접근할 수 있게끔 지원하는 시스템을 갖췄다. 이를 중심적으로 분석하기 위해 본 연구는 유럽의 투자상품이 어느 정도 수준까지 인프라 민간투자사업을 촉진시키는지 검토한다. 본 연구는 EPBI 의 시험 단계에 수행된 프로젝트들은 위험 부담 방식을 개선과 전문 지식을 증가에 긍정적 영홍을 미치는 것을 보인다. 그러나 이 제도가 위험이 높은 프로젝트에 미치는 영향은 아직 불확실하다.

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Tables and figures

I. Introduction

Infrastructure is a key asset when it comes to development. (Aschauer, 1990) shows for instance that infrastructure improves "quality of life, in terms of health, safety, economic opportunity and leisure time and activities, and economic performance". The rationale for infrastructure development consists in the fact that any individual, company or organization need at least a basic access to energy, water, transport, education or health facilities achieve development.

Infrastructure is commonly considered as a public good and a natural monopoly. Indeed, infrastructure is often non-excludable and non-rivalrous in consumption. Also, infrastructure requires a high amount of capital characterizing it as a natural monopoly. Considering those characteristics, financing infrastructure had been undertaken by the public sector, given that costs are too high to be borne by a single private agent, but as there is a significant impact on social welfare, governments had consented to correct directly this market failure.

In the recent decades, due to fiscal constraints of governments, there has been an underinvestment in infrastructure, and the expression "infrastructure gap" has been used more and more. The infrastructure gap refers to the difference between the actual amount invested in infrastructure and demand level for infrastructure. Infrastructure investment needs are estimated to 3.6 percent of global GDP per year for the period from 2016 to

2013, amounting USD 3.3 trillion per year (McKinsey Global Institute, 2016), of which 60% concerns developing countries. In 2016, total investment in infrastructure accounted for USD 413 billion (Plimmer, 2017).

In parallel to the lack of public investment in infrastructure, governments, first in the developed countries, have implemented public-private-partnerships (PPP) frameworks so that these investments could be supported by the private sector. The justification of PPP relies on the idea that thanks to an improved risk sharing model, private sector is more efficient to finance, construct and operate infrastructure, even if financing costs borne by the private sector are generally higher than public debt's. The United Kingdom has pioneered the use of PPP by passing the Private Finance Initiative law in 1992.

To finance PPP projects, investors, be it specialized infrastructure funds, pension funds or contracting companies, usually use project finance techniques. Project finance consists in providing debt that is expected to be repaid by the only future cash flows of the project. As cash flows of an infrastructure project is usually stable (e.g. there is no high volatility of car traffic on a highway) or even contracted with the procuring authority, lenders do not require a recourse on the borrowers' own equity.

The 2008 financial crisis has slowed, however, the use of project finance, that had been increasing in the beginning of the 2000s. Banks have been facing stricter regulation as

the evolution of Basel rules set stronger conditions on equity and liquidity ratios for commercial banks, decreasing thus the banks' lending capacities.

On the other hand, institutional investors retain a large pool of available capital, to increase their investments in infrastructure. Institutional investors such as pension funds and sovereign wealth funds hold around USD 100 trillion in assets (Arezki, Bolton, Peters, Samama, & Stiglitz, 2016) and try to invest in long-term assets that generate stable cash flows.

As the crisis went on, governments tried to push investments in infrastructure. In this perspective, the European Project Bond Initiative aims to boost capital availability for key European infrastructure projects, and to better channel better the available funds to infrastructure projects.

In the European context, investment in infrastructure is considered as a priority by European governments and institutions of the European Union (EU). To respond to this need of investment in infrastructure, the European Commission launched the European Project Bond initiative.

The thesis will study the mechanism by which the European Project Bond Initiative, enables the mitigation of barriers to privet investment in infrastructure.

II. Theoretical framework: public-private partnerships

1. Origin of the concept

Modern PPP framework has been introduced in 1992 by the British government, then led by the conservative John Major, in the so-called Private Finance Initiative (PFI). It was argued that, in a context of fiscal constraint, PFI was the only option allowing the United Kingdom to develop needed infrastructure such as transportation infrastructure, or healthcare facilities. At first criticized by the Labour opposition, PFI remained at the change of government in 1997, and the United Kingdom is still a leading country in terms of projects developed under PPP. By 2009, 800 PFI have been passed and valued GBP 64 billion (HL., House of Lords, 2010).

From this British experience, public-private partnership has been implemented in a growing number of countries, both advanced and developing. Task-forces have been created within states, or in international financial or development institutions to promote the use of public-private partnerships. The number of projects developed under PPP has been increasing since then. In particular 1300 PPP contracts have been signed in the EU, valuing a total of EUR 250 billion. (European Investmen Bank, 2010).

The growing number of projects developed under public-private partnership and the creation of task-forces have allowed to standardize the practice of public-private

partnership around the world, even though PPP is a diverse and complex reality to apprehend, due to the specificities of each country.

However, we can provide general principles that rule the use of PPP. The European Commission, for instance, gives four criteria to identify such operations (European Commission, 2004):

- "A cooperation between the public and the private partner on the long run, concerning on several aspects of a project
- A financing mode which associates the private and the public sector
- An important role of the private partner, who can participate at multiple stages of a project (conception, construction, operation, financing)
- Risk sharing between the public and the private partner, given the ability of each partner to evaluate, control and manage the risks associated to the project"

(European PPP Expertise Centre, 2016) defines a PPP as "an arrangement between a public authority and a private partner designed to deliver a public infrastructure project and service under a long-term contract. Under this contract, the public authority makes a performance-based payment to the private partner for the provision of the service (e.g. for the availability of a road) or grants the private partner a right to generate revenues from the provision of the service (e.g. tolls from users of a bridge). Private finance is usually at risk."

PPP can thus be considered as a set of contracts concluded between the project company, set up specifically for the purpose of the project – also called Special Purpose Vehicles (SPV) –, and the stakeholders to the project. Figure 1 summarizes the different relationships involved in a PPP.

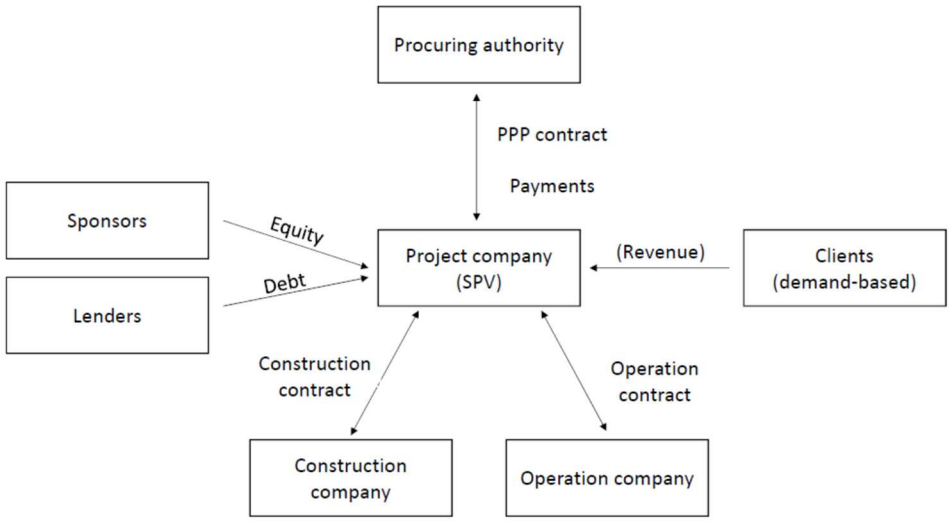

Figure 1 PPP contractual structure (Source: author)

The main contract, also called PPP contract, is passed between the procuring authority and the project company. It specifies which is the scope of the project, the securities that the SPV has to bring, the duration of the contract, the guarantees and payment mechanisms (if relevant), etc. It is the core contract of the project, and all other contracts, in particular the financing contract, are designed in function of this contract, taking into consideration the risks that are transferred to the private company.

The second important aspect of a PPP is the financial structure. In a PPP, the private partner is supposed to bring all or part of the capital required to finance the investment. Finance is subdivided mostly between equity brought by the sponsors of the project, and debt that is provided by banks or capital market.

Here the most generalized scheme has been presented. However, other schemes can be designed, for instance with a mezzanine debt or the injection of public capital in forms of debt or equity.

The third main relationship takes place between the SPV and the contractors relevant to the construction phase and operation phase.

If this general structure is unchanged from one project to another, there are a vast number of possible contractual and financial structures. Main differences are based on the project's scope and the payment mechanism. For the project scope, a project including both construction and operation phase is called a greenfield project, while a project including only the operation phase is called a brownfield project. For the payment mechanism, the SPV can bear the demand risk that exists for the future revenues of the project company, thus we distinguish demand-based projects from availability projects, where revenues are based on the availability of the infrastructure and made by the procuring authority. To capture the variety of PPP, an analytical framework of PPP is proposed in (Carbonara, Costantino, & Pellegrino, 2013), in which three layers are distinguished: country, sector and project. Each layer is subdivided in dimensions and

variables that help creating a typology of public-private partnerships. Table 1 below presents the proposed analytical framework.

Layers	Dimensions	Variables		Values
Country	Institutional	Political-ideological influences		Existence of national programs supporting PPP
		Design of government institutions		Centralist
				Federalist
		Attitude towards and use of New Public Management in public administration		Degree of outsourcing of public services to private sector
	Legal	PPP formalization by a Government legal/statutory framework		Degree of level of regulation by the legal framework (all/few aspects of PPP are formally regulated through the framework)
	Economic	Taxation and its change		Level of taxation
		Indebtedness		Level of public debt
		Investment needs		Development of new infrastructure
				Maintenance of existing infrastructure
	Financial	Access to capital and credit markets		Existence of strong constraints to obtain capital/credit
Sector	Industry organization	Regulatory regime		Regulated
				Deregulated
		Organizational structure		Level of private sector participation
	Market Structure	Demand		Level of demand
				Elasticity of demand
		Competitors		Market monopoly
				Existence of substitute services (in other subsectors)
				Existence of substitute routes (in the same subsector)
	Performance	Attractiveness/profitability		Potential revenues/earnings
Project	PPP arrangement's structure	Contract type	Based on the legal structure of the transaction	Institutional PPP
				Contractual PPP
			Based on operational aspects	Management contract
				Leasing model or Build-Lease-Transfer
				Design-Build (and Design-Build with warranty)
				Design-Build-Operate-Maintain
				Design-Build-Finance-Operate
				Build-Operate-Transfer
				Build-Own-Operate-Transfer
				Build-Own-Operate
		Use of private resources and expertise		Degree of involvement of the private sector in the lifecycle of the project (from design to management)
		Time horizon of contract		Medium term (less than 25 years)
				Long term (more than 25 years)
		Revenues sources	Payments based on usage volumes or demand	By private sector
				By public sector
				By public and private sectors
			Public financial contribution	Lump sum payment by public sector
		Special purpose vehicle (SPV)	Company ownership	Private company
				Publicly- and privately-held company
			Partnership structure	Number and composition of partners
		Risk allocation		Private sector
				Public sector
				Shared between public and private sectors
	PPP arrangement's financing	Use of private finance		Financing in whole by the private sector
				Financing partially by the private sector
				Government-funded projects (no private capital)
		Type of funding options		Bank debt
				Equity
				Bonds
				Loan from shareholders
				Mezzanine finance
		Debt to equity gearing		Low (debt below 70%)
				High (debt exceeds 70%)
		Investment value		Low
				High

Table 1 : The three-layers PPP framework: dimensions and variables (Source:(Carbonara, Costantino, & Pellegrino, 2013))

The attractiveness of such instrument is often explained by the fiscal constraint of governments, since PPP was a way to record public investment off balance sheet, and thus worsening the public debt ratio. However, the use of PPPs is justified by several theoretical contributions that are presented in the next section.

2. Theoretical justifications

PPPs have often been criticized, since it was believed to be used to bypass the public sector's fiscal constraints. Public sector could indeed record the debt of PPP off their balance sheets, even though nowadays, Eurostat provides precise guidelines for the accounting of PPP's debt, which depends on the risk-sharing pattern (Eurostat, 2016). However, PPPs can find other justifications than to be an unorthodox fiscal instrument.

Policy makers justify the use of PPP by the assumption that the private sector is better suited to deliver services than the public sector. Risks transferred in the PPP contract are expected to be better managed by the private sector than by the public sector. The PPP contract features thus risk sharing, that creates a win-win situation.

This justification is framed in the economic literature by the principal-agent model, and, in particular, the incentive theory and the contract theory. From an economic perspective, PPP is a relevant instrument, if the PPP contract is designed such as it features the incentives to capture the best efforts that the private sector put in the project.

A first simple model was developed by Hart (2003), in which he investigates on the beneficial outcomes for the public sector to bundle (construction and operation) the project. The PPP contract as modelled in Hart's article is an incomplete contract since the private agent can make diverse types of decisions affecting the quality of the infrastructure, but without violating the contract.

In Hart's model, there is a time line with three dates, 0, 1, 2. The construction phase occurs between 0 and 1, while the operation phase takes place between 1 and 2.

Hart assumes that the builder can either make an investment *i* which is productive and improves the infrastructure, or make an investment *e* that is unproductive.

He then considers the following two equations:

$$B = B_0 + \beta(i) - b(e)$$

$$C = C_0 + \gamma(i) - c(e)$$

Where $\beta, b, \gamma, c > 0, \beta' > 0, b' > 0, \gamma' > 0, c' > 0, \beta'' < 0, b'' > 0, \gamma'' < 0, c'' < 0.$

B is the benefit to society while C is the cost of operation borne by the operator.

Under perfect information, equilibrium is reached with: $((i, e) = (i^*, e^*)$, such as $\beta'(i^*) + \gamma'^{(i^*)} = 1$.

Hart then introduces imperfect information and considers two cases: unbundling and bundling (or PPP).

In the first case, the government pays at date 0 the price P_0 to the builder for the construction of the infrastructure. The builder will choose i and e, such that $P_0 - i - e$ is maximized. Thus, the builder will choose $\hat{\imath}$ and $\hat{e}$ such as $\hat{\imath} = \hat{e} = 0$.

In the operation phase, the government will pay the cost of operation borne by the operator, that is $C = C_0 + \gamma(\hat{\imath}) - c(\hat{e})$, where $\hat{\imath}$ and $\hat{e}$ are depending on the investment choices made by the builder.

In this case, the government's net payoff is: $B - C - P_0 = B - C - i - e$, with $\hat{\imath}$ and $\hat{e}$ equal to 0.

In the second case, the government bundles the construction and the operation. Here the private partner will try to maximize $P_0 - C - i - e = P_0 - C_0 + \gamma(i) + c(e) - i - e$.

First order conditions are $\gamma'(i^{\wedge\wedge}) = 1$ and $c'(e^{\wedge\wedge}) = 1$.

In this case, the government's net payoff is: $B - P = B - C - i - e$, with $i = i^{\wedge\wedge}$ and $e = e^{\wedge\wedge}$

Figure 2 shows the different PPP equilibria of the model. First best (i^*, e^*) under perfect information, and second bests, ($\hat{\imath}$, $\hat{e}$) with unbundling and ($i^{\wedge\wedge}$, $e^{\wedge\wedge}$) with unbundling, under imperfect information.

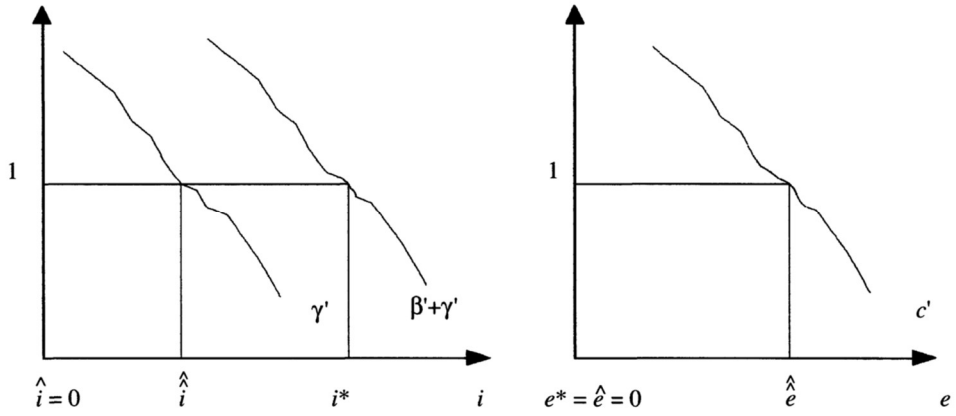

Figure 2 PPP equilibriums: first best and second bests (Source: (Hart, 2003))

Thus, when there is no bundling, the contractor does not internalize either B or C, by setting $i = e = 0$.

When the contracts are bundled, the contractor internalizes C but not B. It sets (i, e), such as $\hat{\imath} < i < i^*$ and $e > 0$.

Hart thus concludes that bundling is beneficial if quality of service can be precisely specified[1]. The trade-off between underinvestment in i in unbundling and the risk of positive e can be solved when information on quality of service, hence on c is known.

Following the model of Hart, Iossa and Martimort developed a generalized model of PPP (2015). From literature review, they conclude that the value created by PPP is ambiguous: if some PPP reach their objectives, some other failed. Their model has thus the ambition

[1] For instance, Hart argues that it is difficult to specify the quality of service outcome for prisons or schools. Hart points out, that for hospitals, event though not straightforward, it is possible to come with performance measures (e.g. treated patients).

to "identify circumstances in which the main characteristics of PPPs are suitable to provide adequate incentives for private contractors in infrastructure and public service provision". According to the authors, two issues are crucial in the economics of PPPs: "the first one is the existing agency costs borne by governments when delegating to the private sector the task of providing a public service. The second one concerns risk-sharing between those parties."

The model is based on the following three main features of PPPs: "tasks bundling", "risk transfer" and "long-term contract", and is built as follows:

Benefits are captured by $B = b_0 + ba + de + \eta$, with *a,* the effort to improve quality of the infrastructure, *e,* the operating effort and η, a random shock normally distributed with variance σ_η^2 and zero mean. $b_0 \geq 0$, and there is thus a base level of benefit, obtained without any specific effort.

Costs are captured by $C = \theta_0 - \gamma e - \delta a + \varepsilon$, with θ_0 the base level cost of the service, $\gamma > 0$, δ captures the externality (positive for positive externality and negative for negative externality), ε captures the operational risk and is normally distributed with variance σ_ε^2 and zero mean.

Iossa and Martimort consider quadratic monetary costs $\frac{a^2}{2}$ and $\frac{e^2}{2}$ respectively for quality-enhancing effort and operating effort.

The goal of the government (*G*) is to maximize the benefits after retrenching the payments (*t*) to the contractor, while the contractor maximizes its payoff which is $\Pi + t - \frac{a^2}{2} - \frac{e^2}{2}$, where Π is B – C if users pay or – C if they do not.

Regarding the bundling, the authors conclude that bundling is beneficial in the presence of positive externality.

This model is used as well to capture other features of PPP, especially the benefits of private finance in a PPP contract. The introduction of outside finance is beneficial as it gives an extra incentive to the contractor to improve its efforts, since repayments are conditioned to this effort, assuming that financiers have access to the informative signal. The authors conclude that "bundling private finance and operation is optimal when outside financiers have access to some informative signal on the operator's effort level. The power of incentives unambiguously raises and aggregate welfare improves with respect to public finance."

PPP is thus justified by economic theory, since extra benefits can be generated, respective to the traditional procurement. Also, the use of private finance is justified, as it creates incentives for the contractor to make additional efforts, that will generate the extra benefits of the PPP. However, this holds under the condition that information on the firm's profits or costs is observable by the contracts' counterparts.

The theoretical literature also distinguishes some specific features of infrastructure finance, such as long-term investment, high capital intensity, risk sharing and complexity of the contractual structure.

III. Research question and methodology

1. Hurdles to infrastructure finance in the European Union

With the development of PPP, a new financing technique, project finance, became more and more popular. Unlike traditional corporate finance, project finance consists in providing debt on the basis of the project's own ability to repay this debt. In (Esty, 2004), project finance is defined as a technique that involves "the creation of a legally independent project company financed with equity from one or more sponsoring firms and non-recourse debt for the purpose of investing in a capital asset". Esty explains then that project finance is considered as a relevant financing option for large projects especially. One key characteristic of project finance is the high leverage of the project (usually from 70% to 90% of debt ratio). It also makes possible investment in positive net present value projects, while in a traditional corporate finance framework, risks associated to large and long projects refrain from investing. Esty considers as well that project finance is a rich field of research as it provides a clear setting that allows studies of managers' decisions regarding financing decision in a context of capital market imperfections.

Project finance is now a well-practiced technique, and many authors have studied its specific mechanism (Yescombe 2002, Esty 2004, Lyonnet du Moutier 2006). Project finance is based on the expected cashflows that the project will generate over the lifetime of the contract. Main financial indicators that are used by the stakeholders are calculated

from these cashflows. Thus, the lender will look at the debt service coverage ratio to see if it will be repaid[23], the sponsors focus on the internal rate of return to estimate the value-for-money of the project, etc. As in the PPP case, there are a lot of actors involved in project finance: the project company, the sponsors, the lenders, the procuring authority.

Considering those theoretical concepts, this section will focus on the literature that research on the reasons for which there is a market failure in the financing of infrastructure.

Why do the private sector invest in infrastructure? In the financing of an infrastructure under PPP, different type of agents within the private sector decide to invest in infrastructure through three main types of vehicles. For each type of agent, motivations are different. Focusing on institutional investors that seek to buy infrastructure bonds, their motivation matches the features of the infrastructure asset. Pension funds and insurance companies are attracted by long-term investments, with stable cashflows, for high amounts of investments (Inderst, 2010).

[2] Debt service coverage ratio refers to the cashflow available after operating expenditures over the period debt service
[3] Other ratios, such as the Loan Life Coverage Ratio (present value of expected cashflow over present value of remaining debt), are also taken into account in the financial analysis

Each actor has its specific motivation to provide finance to an infrastructure project. However, in the European Union, as other markets, the infrastructure gap can be observed. Why is this infrastructure gap still persistent in the European Union?

The hypothesis of weak supply can be rejected, as there is in the EU an excess of liquidity, since the loose monetary policy decided by the European Central Bank has abounded the financial market with liquidities. Thus, the explanation for the persistent market failure in the EU resides in the specificities of the investment in PPPs.

From the features of the infrastructure asset described in the theoretical framework, it is possible to set the following framework that describes why the infrastructure gap is still persistent

Conditions under which the private sector invest in infrastructure procured under PPP:

- Ability to provide high amount of capital
- Ability to provide capital on the long run
- Attractive risk-sharing structure
- Ability to manage the complexity of PPP investments

Due to the two features inherent to the infrastructure asset (capital intensity and long lifetime), banks, which were traditionally the major providers of debt, are no more able to bring sufficient capital to finance infrastructure PPP. Indeed, since the 2008 financial crisis, stricter regulations have been implemented, and limit the lending capacity of banks. Basel III regulations imposes to banks a reduction of their exposure to risks.

However, banks are not the only debt providers that can bear the risks associated to capital intensity and long lifetime. Institutional investors, such as pension funds and insurers, have a lot of liquidity, that they seek to invest in infrastructure.

Then, why is there a lack of private investment from institutional investors in infrastructure procured under PPPs?

The literature review carried out by this thesis brings some convergent reasons.

In (European Investment Bank, 2010), barriers reducing the attractiveness of PPPs as listed securities:

- The disappearance of monolines
- Confusion on the underlying asset of project bonds, e.g. with utility companies
- The lack of expertise among institutional investors to structure, negotiate and control PPP project financing
- The absence of benchmark and clear definition regarding infrastructure as an asset class
- Non-investment grade project bonds
- The absence of prime grade project bonds, following the downgrading of monolines
- Foreign exchange hedging when applicable

(Roland Berger, 2015) identifies five barriers to infrastructure investments in the European Union:

- Risk-sharing in most of the projects are inappropriate regarding the offered yields
- There is no standardized and reliable regulatory framework in the EU for public-private partnerships
- Stricter regulations imposed on banks and insurances companies
- Creditors' control mechanisms do not match investor's requirements
- Non-standardization of the projects leads to too higher costs

(Walter & al., 2016) points out five hurdles to private investment in infrastructure

- "No alternative to robust debt markets
- Banking pressures

  Infrastructure finance expertise
- Liquidity issues
- Lack of viable infrastructure projects"

(Ehlers, 2014) states that investing in infrastructure requires an expertise which is costly. Therefore, the lack of properly structured projects is a barrier to private investment.

From the above review, it is possible to sum up the conditions under which private investment in infrastructure is made possible.

Condition	Participant	Status
Ability to provide high amount of capital	Banks	Not met
	Institutional investors	Met
Ability to provide long-term financing	Banks	Not Met
	Institutional investors	Met
Attractive risk-sharing structure	All	Depends on the project's characteristics
Ability to manage complex contracts	All	Depends on the participant

Table 2 Reasons for the infrastructure bottleneck (Sources: above literature review)

Specifically, for the risk-sharing, we can refer to the risks listed by (OECD, 2008):

- Global risk: that is not controllable by the project company, also known as "force majeure" risk
- Elementary risks that can be managed by the project participants:
    - Political risks
    - Credit risks, related to the creditworthiness of the SPV
    - Country risks, related to the sovereign rating
    - Project risks:
        - Completion risk or construction risk
        - Operation and maintenance risk
        - Revenue risk
        - Financing risk

2. Research question

Through a study of existing literature, this thesis has so far explained the concepts, theories and challenges inherent to private investment in infrastructure under public-private partnerships in the European Union.

It has highlighted the initial paradox that consists in the existence of a market failure for the financing of infrastructure: despite the large amount of capital available on the capital markets and the appetite of the investors for infrastructure assets, the infrastructure gap is still persistent.

Literature sheds light on the hurdles that hinder private finance for infrastructure, explaining the paradox. Two key reasons are identified as barriers for private investment in infrastructure procured through PPP: the inadequate risk sharing structure of the projects and the lack of expertise of some actors from both public and private sectors.

To solve this market failure, a public intervention could be needed. This problem is, of course, well known from the policy makers, at regional, national or international levels. In the European Union, the European Commission and the European Investment Bank launched jointly in 2011 the European Project Bond Initiative, that seek to boost capital market participation in European infrastructure through a credit enhancement of project bonds.

This thesis will thus, through a case study of the European Project Bond Initiative examine to what extent this European instrument facilitate private investment in infrastructure in the European Union.

The case study will show how the instrument proposed by the European institutions reduces or not the difficulties in infrastructure finance identified so far. Also, the specificities of the European Project Bond Initiative will be analyzed through a comparison with the existing instruments offered already by the European Investment Bank.

This thesis formulates three hypotheses that will be checked in the following sections:

1- The EPBI enables a more attractive risk sharing structure for the bond investors
2- The EPBI fills the lack of infrastructure expertise of both public and private sectors
3- The EPBI is needed as it complements the scope of products offered by the European Investment Bank

3. Methodology

This thesis will carry out a case study of the European Project Bond Initiative. Ten projects, which have been financed with this instrument, will be analyzed and a comparative analysis with two other European instruments will be provided.

For the purpose of this research, data has been collected from various sources:

- Publications from the European Investment Bank and the European Commission
- Ad-hoc audit report of the European Project Bond Initiative
- Prospectus of the project bonds when available
- Publications from credit rating agencies
- Articles in specialized publications (*Project Finance International*, *International Financial Law Review*, etc.)
- Opinion papers

However, due to the private characteristic of studied projects and the confidentiality attached to PPP and financing contracts, publicly available data is rare. This thesis conducts an analysis following the pattern exposed in the previous section, but presents some limitations due to the difficulty to access data.

IV. Case study

1. Context of the EPBI

1-1. Project bonds before the 2008 financial crisis

Project bonds are not new to the European Project Bond Initiative. A project bond refers to a specific type of debt security, issued to finance infrastructure projects. Contrary to usual corporate bond financing, project bonds are issued with a project finance basis, that is the bonds are to finance a specific project and not a company as a whole, and the risk associated to the project bond is linked to the ability of the project to generate sufficient cashflows to repay the debt, not to the credit quality of the company. However, literature on project bonds sometimes consider project bonds the bonds issued by utilities companies or by development banks (Inderst, 2010). This thesis will consider a narrow definition of project bonds, as bonds issued by specific project companies (SPV) created for the purpose a specific project.

Project bonds have been already used before the 2008 financial crisis to finance infrastructure, mostly in the United States. Back then, project bonds were wrapped bonds, which are guaranteed bonds by a monoline insurer[4]. This arrangement had the advantage to enhance the credit rating of project bonds. A wrapped bond benefited from the higher rating of the monoline than the bond issuer's rating.

[4] A monoline insurer is an insurance company that provides only financial guarantee, and differs thus from a traditional insurance company.

Monoline insurers protect the investor against the default risk of the bond. Before the financial crisis, the bond wrapping allowed project bonds to benefit from top credit rating such as AAA, thus lowering the financing cost of an infrastructure project.
Bonds offer also longer tenor than traditional bank debt (bonds can be issued for tenor longer than 20 years, while banks often offer a maximum of 10 years tenor). This longer tenor is thus attractive for infrastructure project company, as the sponsors internalize the internal rate of return, which is computed over the entire lifetime of the asset.

Bond financing was convenient, but it cannot represent a solution to the lack of capital for infrastructure projects, since project bonds were used mostly for brownfield projects, with a lower risk associated to the infrastructure project. It was used by the sponsors of a project to refinance a bank debt that was used during the construction phase. As the number of bondholders are also higher than the number of banks which would finance an infrastructure project, it is easier to manage this construction risk with bank debt, and then refinance through bonds at the operational phase.

With the 2008 financial crisis, monoline insurers have disappeared from the financial landscape. Monoline insurers started to guarantee in the US subprime mortgages, and thus default rate skyrocketed with the burst of the US real estate bubble. Rating agencies downgraded the credit rating of monoline insurers.

The global financial crisis has made irrelevant the wrapped bond financing model for infrastructure, but it also led to stricter regulations for financial institutions. Basel III rules will thus impose stronger requirements for banks on equity, leverage and liquidity ratios. Banks, under this regulation, are required to reduce their exposition to high leverage and long maturity. Similarly, Solvency II rules foster insurance companies and pension funds to target better rated investments.

1-2. EU policy context

The State of the Union Speech, given by José Manuel Barroso, President of the European Commission at that time, proposed the European Project Bond Initiative in September 2010. The instrument has then been officially offered from November 2011 with the cooperation agreement signed by the European Commission and the European Investment Bank (European Investment Bank, n.d.).

For the European Union, the EPBI's objective is to boost infrastructure investment in the EU through capital markets, and *in fine* achieve the EU's strategic objectives set in the Europe 2020 strategy, that had been set up to stimulate growth in the EU. Therefore, the eligibility criteria to the PBCE are designed to foster investment in key projects part of the Trans-European Network for Transport (TEN-T), as defined in Decision No 1692/96/EC, and Trans-European Network for Energy (TEN-E) in Decision no 1364/2006EC. Selected broadband projects are also eligible to the PBCE. The pilot phase was financed with unused EUR 230 million of the 2007-2013 financial framework

of the EU. The Commission expect to reach an investment level of EUR 1.5 trillion to 2 trillion.

Two objectives are given to the pilot phase of the EPBI. First, it should demonstrate the ability of the capital market to deliver financing for infrastructure projects selected by the EU. Second, it should prepare and develop the conditions of the access to capital markets for infrastructure developers.

2. Mechanisms

2-1. Means

Two mechanisms of PBCE are offered by the EIB (European Investment Bank, 2012). The funded PBCE (figure 3) provides a subordinated tranche to the financial structure of the project company. The funded PBCE implies thus a deleveraging of the project company. The subordinated debt is available at the financial close. Amounts for the PBCE has been limited to the minimum of EUR 200 million and 20% of capital expenditures.

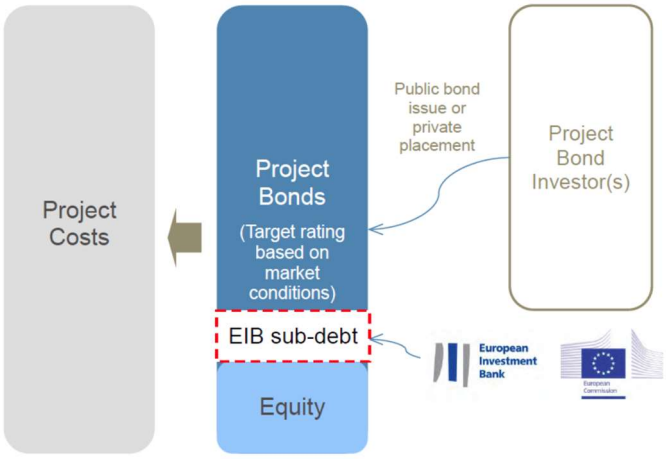

Figure 3 Funded PBCE (Source: EIB)

The unfunded PBCE (figure 4) consists in a letter of credit, providing to the project company a credit line, which can be drawn during the entire life of the project. It acts more likely like a partial guarantee, as the amount of the facility is not included in the financial structure of the SPV.

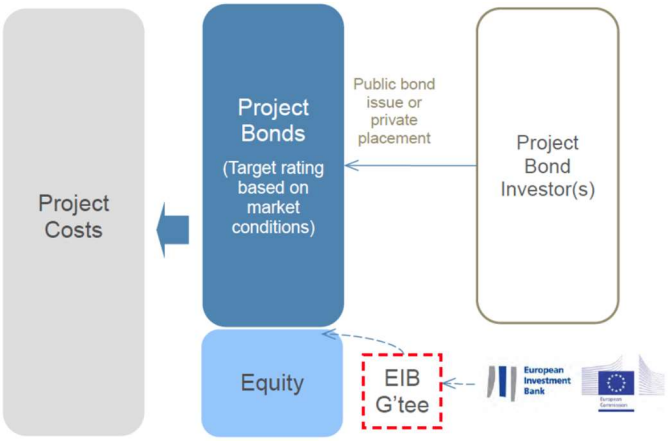

Figure 4 Unfunded PBCE (Source: EIB)

Under the terms of the PBCE letter of credit, the EIB provides additional funding when certain events occur. The prospectus of the senior bonds issued for the financing of the A11 project in Belgium describes these events (VIA A11 NV, 2014):

"(a) *PBCE Funding Shortfall*: to make payment either of certain cash shortfalls, or in respect of Debt Service on the Bonds and the PP Notes (if the Technical Adviser reasonably believes that the PBCE Longstop Date can be met and certain other conditions are satisfied) following a PBCE Funding Shortfall during the Construction Phase;

(b) *Debt Service:* to make scheduled interest and principal payments in relation to the Bonds and PP Notes if there is insufficient cash available to the Issuer for such purposes;

(c) *PBCE Rebalancing Events:* if a PBCE Rebalancing Event (as defined below) occurs, during the Availability Phase, to make payment of mandatory partial redemption amounts in respect of the Bonds and PP Notes; or

(d) *Accelerated Payments*: provided no PBCE Rebalancing has previously occurred, to make accelerated payments (excluding any make-whole amount, costs or indemnities associated therewith) in relation to the Bonds and PP Notes if there is insufficient cash available to the Issuer for such purposes following acceleration of the Bonds,"

2-2. Process

The PBCE does not modify fundamentally the usual process for the procurement of infrastructure public-private partnerships.

The possibility to include PBCE in the financial structure of the projects is evaluated at the beginning of the process, when the bid call is designed.

Then, the procurement follows an usual process, that is, bid submission, BAFO (best and final offer) submission, and closing (European Investment Bank, 2012).

3. Current status

Ten projects reached successful financial close by the end of the pilot phase of the European Project Bond Initiative. Projects financed during the pilot phase embrace a diverse scope of sectors, countries and type of projects. The EPBI's project-record is thus sufficiently sized to allow a qualitative analysis of its impact.

Project name	Sector	Country	Bond size	Size of PBCE	FC[5] date
Castor	TEN-E	Spain	EUR 1.4 bn	EUR 200 m	juil-13
Greater Gabbard	TEN-E	UK	GBP 305 m	GBP 45.8 m	nov-13
A11	TEN-T	Belgium	EUR 577.8 m	EUR 120 m	mars-14
Axione	ICT	France	EUR 189.1 m	EUR 38 m	juil-14
A7	TEN-T	Germany	EUR 429 m	EUR 85 m	août-14
Gwynt y Mor	TEN-E	UK	GBP 392.2 m	GBP 51 m	févr-15
Port of Calais	TEN-T	France	EUR 504 m	EUR 50.4 m	juil-15
West of Duddon Sands	TEN-E	UK	GBP 254.8	GBP 38.2 m	août-15
N25	TEN-T	Ireland	EUR 145.4 m	EUR 22 m	janv-16
Passante di Mestre	TEN-T	Italy	EUR 830 m	EUR 166 m	avr-16

Table 3 Projects financed with PBCE (Source: author's research)

Table 3 gives a brief description of the projects financed with PBCE during the pilot phase of the EPBI.

4. Analysis

4-1. Impact of the EPBI on risk sharing

4-1-1. Credit risk

Project name	Initial rating	Achieved rating	Evolution
Castor	BBB (Fitch)/BBB- (S&P)	BBB+ (Fitch)/BBB (S&P)	+2
Greater Gabbard	Baa1	A3	+1
A11	Baa3	A3	+3
Axione	Ba1	Baa2	+2
A7	Baa2	A3	+2
Gwynt y Mor	Baa1	A3	+1
Port of Calais	BBB- (Fitch)	BBB (Fitch)	+1
West of Duddon Sands	Baa1	A3	+1
N25	Baa3	Baa1	+2
Passante di Mestre	Baa1	A3	+2

Table 4 Evolution of rating (Sources: EY, S&P, Moody's, Fitch)

[5] Financial close

Table 4[6] shows that all projects financed in the pilot phase of the European Project Bond Initiative benefitted from an upgrade of their credit rating. On average, the projects' credit ratings were upgraded by 1.7 notch above their initial rating.
The ratings have been upgraded at least by one notch and the A11 project in Belgium benefited from a 3-notches upgrade.

Out of the ten projects, six of them achieved a single-A rating. Single-A rating is qualified as "upper medium grade", "high grade" or "premium" (Multiple Markets, 2013). A single-A rating demonstrates the high quality of the credit, and thus improves the liquidity of the bond. The PBCE has thus an impact on the liquidity of the project bond market. This impact on liquidity is however only expected and cannot be assessed, as the size of the bond market is still limited.

Regarding initial ratings, we observe that only one project, Axione broadband project in France, was considered non-investment grade (i.e. below BB+/Ba1/BB+ according to Standard and Poor's/Moody's/Fitch respectively). Bonds issued by Axione achieved an investment grade rating with the EPBI credit enhancement. The PBCE demonstrates thus the deliverability of the instrument for non-investment grade projects, however, the small number of non-investment grade bonds enhanced by PBCE shows that appetite

[6] In the rest of the case study, when unspecified, ratings are given by Moody's. Refer to references for sources for each project.

from the capital markets could have been demonstrated without the instrument, as investment grade condition is shared among many institutional investors.

All projects opted for unfunded option of PBCE, which means, there were appetite from the investors for large tickets.

4-1-2. Country risk

Project name	Country	Achieved rating	Sovereign rating at FC
Castor	Spain	BBB+ (Fitch)/BBB (S&P)	BBB (Fitch)/BBB- (S&P)
Greater Gabbard	UK	A3	Aa1
A11	Belgium	A3	Aa3
Axione	France	Baa2	Aa1
A7	Germany	A3	Aaa
Gwynt y Mor	UK	A3	Aa1
Port of Calais	France	BBB (Fitch)	AA (Fitch)
West of Duddon Sands	UK	A3	Aa1
N25	Ireland	Baa1	A3
Passante di Mestre	Italy	A3	Baa2

Table 5 Country risk (Source: (Trading Economics, n.d.))

Two projects reached financial close with a rating above the sovereign rating of the country. The Castor gas storage project achieved a BBB+ (Fitch) rating, one notch above the BBB (Fitch) rating of Spain. Also, the Passante di Mestre project in Italy reached A3 (Moody's), two notches above the Italian sovereign rating (Baa2, Moody's).

Looking at the country breakdown of the projects carried out during the pilot phase, we observe that all the projects are located in the old member states (OMS), i.e. EU members prior to 2004, of the European Union. Besides, the majority of the projects are located in single-A rated countries, and no projects are in the non-investment grade countries (Table 6). Also, the A7 project is located in Germany, that has prime grade sovereign rating (AAA/Aaa/AAA, Table 7).

EPBI thus demonstrated the deliverability of projects with a rating above the sovereign rating, however, deliverability in non-investment grade countries has not been tested.

	S&P	Moody's	Fitch
Croatia	BB	Ba2	BB
Cyprus	BB-	B1	BB-
Greece	CCC	Caa3	CCC
Portugal	BB+	Ba1	BB+

Table 6 Non-investment grade sovereign ratings (Sources: S&P, Moody's and Fitch)

	S&P	Moody's	Fitch
Denmark	AAA	Aaa	AAA
Germany	AAA	Aaa	AAA
Luxemburg	AAA	Aaa	AAA
Netherlands	AAA	Aaa	AAA
Sweden	AAA	Aaa	AAA

Table 7 Prime grade sovereign ratings (Sources: S&P, Moody's and Fitch)

4-1-3. Revenue risk

Project name	Achieved rating	Notches lift	Revenue source
Castor	BBB+ (Fitch)/BBB (S&P)	+2	Demand
Greater Gabbard	A3	+1	Availability
A11	A3	+3	Availability
Axione	Baa2	+2	Demand
A7	A3	+2	Availability
Gwynt y Mor	A3	+1	Availability
Port of Calais	BBB (Fitch)	+1	Demand
West of Duddon Sands	A3	+1	Availability
N25	Baa1	+2	Availability
Passante di Mestre	A3	+2	Demand

Table 8 Revenue risk (Source : author's research)

PBCE was delivered for both demand- and availability-based projects. Usually, demand-based projects have more difficulties to attract investors, as the revenues are not guaranteed or stable. However, the provision of a contingent letter of credit by the PBCE covers this risk. When a shortfall of cashflow occurs, the PBCE will allow the bondholders to be repaid accordingly to the payment schedule.

4-1-4. Construction risk

Project name	Achieved rating	Notches lift	Construction risk
Castor	BBB+ (Fitch)/BBB (S&P)	+2	Brownfield
Greater Gabbard	A3	+1	Brownfield
A11	A3	+3	Greenfield
Axione	Baa2	+2	Brownfield
A7	A3	+2	Greenfield
Gwynt y Mor	A3	+1	Brownfield
Port of Calais	BBB (Fitch)	+1	Brownfield
West of Duddon Sands	A3	+1	Brownfield
N25	Baa1	+2	Greenfield
Passante di Mestre	A3	+2	Brownfield

Table 9 Construction risk (Source : author's research)

The pilot phase of the EPBI delivered three greenfield projects, with subsequent construction risk. The three projects are all from the TEN-T sector. The European instrument successfully upgraded the credit rating attached to the bond issued for A11 in Belgium, A7 in Germany and N25 in Ireland.

Also, the most important impact of the PBCE is observed for the A11 project, a 12-km extension of the A11 highway from Brugge to Westkapelle, that will link the port of Zeebrugge and the European highway network. This upgrade shows thus the ability of the market to assess construction risk.

4-2. Impact on infrastructure expertise

4-2-1. Public side

Many investors, even though attracted by the features of infrastructure assets, are unable or it is too costly to identify good projects. The involvement of the EIB in the process will lead to fill this lack of expertise. Indeed, to be eligible to the PBCE instrument, projects must be analyzed and evaluated relevant experts from the EIB.

(European Investment Bank, 2012) provides these evaluation criteria:

- "Technical scope: definition of the project's technical description, technical soundness, innovative technology, risks and mitigation measures, information on capacity for products/services
- Implementation: promoter capability to implement the planned project, information on timing, and employment during operational life
- Procurement: compliance with applicable legislation and EIB guidelines
- Environmental impact: compact with applicable legislation, information on environmental impact assessment
- Market and demand: analysis of the market and demand of the project's products/services over the project's life
- Investment costs: information on project costs and its detailed components, comparison with cost of similar projects

- Profitability: information on financial profitability and related indicators (e.g. rate of return), information on economic profitability"

The EIB provides thus a complete due diligence on the project, that compensate the lack of expertise of procuring authorities or investors. The eligibility to the PBCE shows that the project complies with the European Union's procurement, environmental, social and economic standards, reducing thus the risks during the procuring process. Additionally, the EIB approval is a credible opinion for investment professionals according to Katrina Haley, Head of Structured Bonds at HSBC: "The EIB's credit assessment process is very rigorous, so that gives considerable comfort to certain types of investors, on top of the credit enhancement itself […] To have the EIB beneath you in the capital structure should be very reassuring." (Teague, 2014).

However, projects were delivered in the countries with strong maturities in infrastructure expertise. Notably, UK, France, Germany, Italy are countries where PPP has been implemented since long (Kappeler & Nemoz, 2010).

4-2-2. Private side

Project name	Investors (names when available, or geographic origins)
Castor	Germany, Benelux, Spain, France, UK, Italy
Greater Gabbard	European investors
A11	EIB, Allianz
Axione	n.a.
A7	AXA, KfW IPEX, MassMutual, Aegon, ING, SunLife, EIB
Gwynt y Mor	98% UK based, 78% fund managers, 22% pension funds
Port of Calais	Allianz
West of Duddon Sands	n.a.
N25	Allianz
Passante di Mestre	Allianz (EUR 400m), Generali & Scor

Table 10 Investors (Sources: (EY, 2015), (Messia, 2016), (BAM, 2016))

Concerning the breakdown of the investors that have purchased the bonds, data is difficult to find, due to the confidentiality attached to the financial contracts, however some trends can be drawn.

First, the geographical origin of the investors indicate that they are mostly European investors, meaning that there is no shortage of capital in the local market.

Second, when available, the name of the investors indicate that they are well known investors in infrastructure. So EPBI did not enlarge the base of investors.

Project name	Coupon	GER 10 years	Est. Pricing (Bps)	Achieved rating
A11	4,49%	1,57%	292	A3
A7	2,96%	0,89%	206,7	A3
Port of Calais	3,70%	0,65%	305	BBB (Fitch)
N25	2,68%	0,33%	235,4	Baa1
Passante di Mestre	2,12%	0,28%	183,3	A3

Table 11 Evolution of pricing (Sources: (Investing.com, n.d.), (EY, 2015), (Messia, 2016))

The above projects are presented in the chronological order. The column "Est. Pricing" present the difference between the coupon of the bond and the approximative yield of the underlying risk-free rate, here the German 10-years bond. We thus observe that, for similar projects, that have achieved A3 rating, A11, A7 and Passante di Mestre, the estimated pricing has decreased from March 2014 to April 2016. We can therefore see a growing ability from the investors to assess the risks, and thus to lower their pricing, due to the lower fixed costs attached to the evaluation of the investments opportunities.

4-3. Specificities of the EPBI in the product scope of the EIB

	EPBI	LGTT	MARGUERITE
TARGET VEHICLE	Bond	Loan	Equity
SECTOR	TEN-T, TEN-E, ICT	TEN-T	TEN-T, TEN-E, renewable
OBJECTIVE	Boost market finance for projects in the above sectors	Facilitate private participation in the financing of transport infrastructure projects	Catalyze investments in key sectors identified as such by the EU
MECHANISM	Provision of a subordinated debt tranche or letter of credit, drawable i) during construction phase to meet expenditures, ii) during operating phase to meet senior debt repayments	Provision of an unfunded mezzanine tranche, drawable when revenues generated are insufficient to ensure payment of the senior debt in ramp-up phase	Equity investment in key pan European projects
DURATION	Customized	5 to 7 years	n.a.
AMOUNT	20% of senior bonds	10% of senior debt (up to 20% in some cases)	n.a.
EIB/EU PARTICIPATION	EUR 230 m	EUR 1 bn	EUR 100 m
CREATION DATE	2011	2008	2010
NUMBER OF PROJECTS	10	7	12

Table 12 EIB's infrastructure instruments (Sources : (European Investment Bank, 2012), (Pfeffer, Mawhinney, Lledo Moreno, Gleave, & Yong-Prötzel, 2014), (European Investment Bank, 2016))

The EPBI is the first European instrument to address specifically bond financing. It was conceived to partially fill the space left empty by the monoline insurers.

Compared to the Loan Guarantee Instrument for TEN-T Projects (LGTT), PBCE covers a much larger scope of sectors and risks. Indeed, LGTT was specifically designed for transport projects with traffic-risk.

LGTT was used for instance for the financing of the largest infrastructure project, the Tours-Bordeaux High-Speed Railway in France. It provided a decisive guarantee covering the uncertainty on traffic volumes, especially in the ramp-up phase, in the first years of operation.

PBCE covers a larger number of risks and sectors. It is also more flexible than LGTT, as the duration of its provision can be tailored to the project's need. At last, it provides up to 20% of senior bonds, opposed to 20% of senior debt in the case of LGTT.

Equity investment, such as the EUR 100 million investment in the Marguerite Fund, follows conventional techniques, and equity participation of the EIB only allows to channel financing to strategic assets, but no specific impact on risk sharing can be observed.

V. Conclusion

Do capital markets constitute a solution to face the global lack of investment in infrastructure?

This thesis has shed light on the reasons of the market failure that exists in infrastructure finance, where large amount of capital available does not meet infrastructure demand. Literature analyses the market failure as the result of the lack of viable infrastructure projects, understood as offering proper risk-sharing structure, capable of raising appetite of investors for infrastructure assets, and the lack of expertise regarding infrastructure investment among both some public procuring authorities and some private investors.

To overcome these difficulties, public organizations, such as the European Union, have created specific instruments designed to address those difficulties. The European Project Bond Initiative is one of them.

This thesis carries out a case study of the European Project Bond Initiative, by analyzing the ten projects financed with the underlying credit enhancement mechanism of the European Project Bond Initiative.

This analysis enables to draw some results of the European Project Bond Initiative. On both difficulties of inappropriate risk-sharing of the projects and the lack of expertise, the European Project Bond Initiative has proven to be successful. Particularly, the European Project Bond Initiative has allowed projects with underlying non-investment grade rating, important revenue, country or construction risks to achieve successful

financing. Also, some positive impact can be observed for the lack of expertise, as an internalization of the projects risks occurred throughout the entire period of the pilot phase of the European Project Bond Initiative.

However, some limits have to be underlined to the previous analysis. Most of the projects financed with the credit enhancement instrument of the European Investment Bank faced little, or even none, credit risk and country risk. Most of them were investment grade before the credit enhancement and are located in countries with high sovereign ratings. Besides, the impact on infrastructure expertise is limited, since, on the one hand, the investors involved in the ten projects are investors familiar with the infrastructure asset, and, on the other hand, the selected countries have a strong record of public-private partnerships procurement.

Therefore, the joint public initiative of the European Commission and the European Project Bond Initiative is a relevant instrument to foster private investment in infrastructure through capital markets. This relevance is highlighted by the novelty of such an instrument, as showed by the comparison with existing instruments within the European Investment Bank. However, the European Project Bond Initiative has not been tested on highly risky projects, limiting thus the analysis of its impact.

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